

Does clinical simulation stimulate Higher Order Thinking and the Skills of Higher Order Thinking in medical education?

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Introduction

Higher Education Institutions (HEI's) have invested in high fidelity clinical simulation centres incorporating all three areas of the perioperative pathway. It is suggested clinical simulation contributes to increased patient safety and is therefore encouraged in undergraduate operating department practice (ODP) courses (College of Operating Department Practice [CODP], 2011). A search of the literature, however, fails to uncover studies of the effectiveness of clinical simulation in the field of operating department practice. Studies from medicine and nursing exist, albeit from the perspective of the students' experience and the lecturers' delivering the simulation. The reapproved Diploma of Higher Education Operating Department Practice resulted in the introduction of clinical simulation in the first term whilst the classroom instruction remained unchanged. Therefore a comparison can be drawn between the cohort with classroom instruction only and the following cohort that received the blended theory and simulated learning.

For this study, the student selection process, the clinical placements, and the mentors supporting students were identical for both cohorts. A hermeneutic phenomenological approach was employed to explore the clinical mentors' perceptions of any differences in the students' preparedness to undertake clinical practice and their application of Higher Order Thinking and the Skills of Higher Order Thinking (HOTSHOT) between the two student cohorts (not individual students). The product of this study includes recommendations for development of clinical simulation within the perioperative critical care pathway and its integration through the use of the HOTSHOT taxonomy to a perioperative signature pedagogy (Beckwith, 2018). Dahlberg, Dahlberg and Nyström (2008) assert that the hermeneutic phenomenological approach requires interpersonal interaction within the 'lifeworld' setting in which strong emotions may be revealed while expressing thoughts and ideas important to them. Although the research question was benign, such strong emotions could emotional distress and therefore in the efforts to do no harm, plans were to terminate the interview and provide support for the interviewee.

Ethics

Ethical approval of this study required an intricate examination of the proposed study participants. The aim was to reveal the perceptions of the lead clinical mentors who are key members of the perioperative clinical team. Each lead clinical mentor in this study holds a professional registration in a perioperative role, has three years postqualification experience, and has undertaken mentorship preparation for the support of professionals in practice training at an academic level of 6 or 7. These lead clinical mentors oversee all aspects of the students' clinical placements for the two years of their course giving them the perspective required to have an informed perception. The aim of the study was to acquire the lead clinical mentors' perceptions of the preparedness of two student cohorts (not individual students) to autonomously engage with clinical practice at the point of registration.

The study met the criteria of the Health and Social Care Information Centres (2012) guidance, therefore National Health Service (NHS) ethical approval was not required. However, ethical approval was sought and granted from the host university ethics committee. Submission to this panel considered possible power dynamics between the researcher and proposed participants. This was addressed in the information sheet given to all participants before informed consent was requested.

The participants were drawn from multidisciplinary backgrounds and therefore the study was compliant with the Royal College of Nursing (2009) and Health and Care Professions Council (2017) guidelines. Furthermore, permission from senior managers in each hospital trust was sought and granted. Each participant gave informed consent to be interviewed.

Methodology

The research methodology for this study is phenomenology. Within the world of phenomenological research sits hermeneutics (Gray, 2014). This branch of research affords the researcher the opportunity for personal questioning of that which is being researched, the depth and breadth of the researcher's emersion into the research is at their own discretion (Gray, 2014). Tacit meanings are teased out of the data through the use of personal experience, juggling arguments for and against propositions, the result of which is to create a synthesis of understanding which grows out of the human experience (Gray, 2014).

Research model development

Burton-Jones (2007) explains that a methodological approach to research should provide some structure and focus to the research process to avoid straying from the task at hand. Therefore, it was necessary to create a bespoke research model (figure 1). It was evident that the initial stage required the construction of the initial theoretical model based upon the chosen methodology. Subsequently a literature review (Beckwith, 2018) was undertaken and interview development began. Following Bowling's (2009) suggestions, much consideration was given to the development of the interview format, such as structured or semi-structured interviews and the actual interview questions in attempts to align with hermeneutic phenomenology.

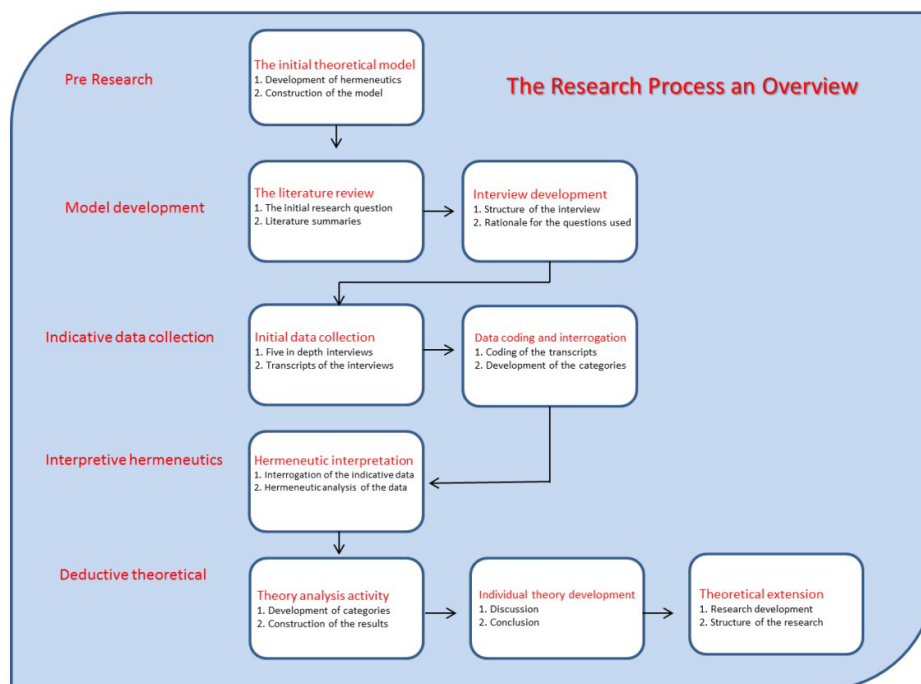


Figure 1

The lived experience, data by another name

Dahlberg, Dahlberg and Nyström (2008) disclosed their objection to "data gathering" as it suggests a conscious choice, as when one is picking flowers. The premise of gathering data is that the subjects' utterances inform what data is recorded, whereas the phenomenological approach of the reflective lifeworld research model relies upon an understanding of the lifeworld (Dahlberg, Dahlberg & Nyström, 2008). In this research, the lifeworld is the object'

which becomes something tangible which can be recorded and analysed. The phenomenological approach of the reflective lifeworld research model, with its interwoven researcher, subject and textural data concepts, best lends itself to my research question and will inform the data collection. A traditional phenomenological school of thought holds that validity is a technical term that means "...this measuring instrument measures what we think it measures ..." (Punch, 2009, p. 246) Therefore, care was taken to assure that interview questions aligned with the research question.

Due to previous experiences as a student, a mentor, and an operating department practitioner, it was clear that this author was an 'insider researcher'. This brought about concern for the 'insider-outsider' dichotomy that could create a bias and influence the results of the study (Gray, 2014). However Chavez (2008, p. 481) asserts there are advantages to the insider researcher as they are more likely to "...understand the cognitive, emotional, and/or psychological precepts of participants as well as possess a more profound knowledge of the historical and practical happenings of the field". There was a realisation that this author understood the nuances presented in the participants' interviews. To be an effective insider researcher required the creation of emotional distance and transparency which was achieved through the application of reflexivity (Chavez, 2008).

Data collection instruments

Having reviewed the theories surrounding data collection, consideration was given to the questionnaire. Whilst the questionnaire is considered a standard for phenomenological research, it can be one dimensional. It was decided that a one dimensional asynchronous approach, whereby a question asked and an answer given was too restrictive for this research question. It was acknowledged that free-text answers lift some of these restrictions, however, not to the extent desired for this study. Telephone interviews were considered with two-way interaction and where answers given could lead to new lines of enquiry. But expressions and body language would not be seen, thus valuable data would be lost. Further consideration was given to technology enhancement of the telephone interview, for example SKYPE™ or Facetime™, to add personal interaction and visual observation thereby adding a third dimension. Whilst an improvement, it was still suboptimal in that the interviewee would be compartmentalised. This compartmentalisation would place restrictions on the phenomenological reflection required in that the researcher must engage in textual emersion with the requirement to go beyond what is seen and heard, placing answers into emotional and atmospheric context (Van Manen, 1997; Moustakas, 1994; Punch, 2009).

This would add a fourth dimension to the data and a texture and richness to the results. It was concluded that face to face interviews would be the method of choice.

When examining the interview process, Dahlberg, Dahlberg and Nyström (2008) state "...interviews are considered collaboratively produced narratives: a mutual product of researcher and informant." Punch (2009) draws upon Patton (2002) to define three main types of interview: informal conversational interview, general interview guide, and standardized open ended interview. Punch (2011) explains that Patton's (2002) work had been informed by Minichiello *et al.* (1990) whose Continuum Model (figure 2) categorised interviews by the degree of structure involved. Because the essence of this study is the lead clinical mentors' perceptions, the interview questions must lead, but not guide, the interviewees. Otherwise, one can lead the interviewee to water, but they must decide how much to drink.

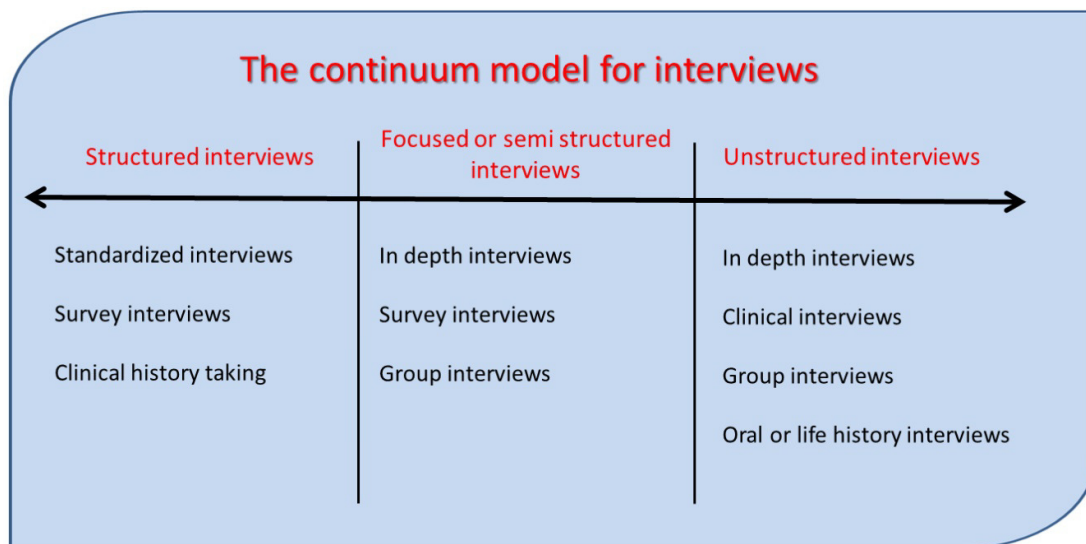


figure 2

Interviewing is commonly understood to be asking questions and the receiving answers, therefore the structure of the interview questions is important. Problem solving is not an artefact of phenomenology, phenomenological questions seek meaning, in the context of this study the meaning is the clinical mentor's perceptions of simulation, higher order thinking skill, and the correlation of these with the cohort comparisons (Punch, 2009; Van Manen, 1997).

Punch's (2009) outline of interview questions have been adapted to suit this study as can be seen in figure 3.

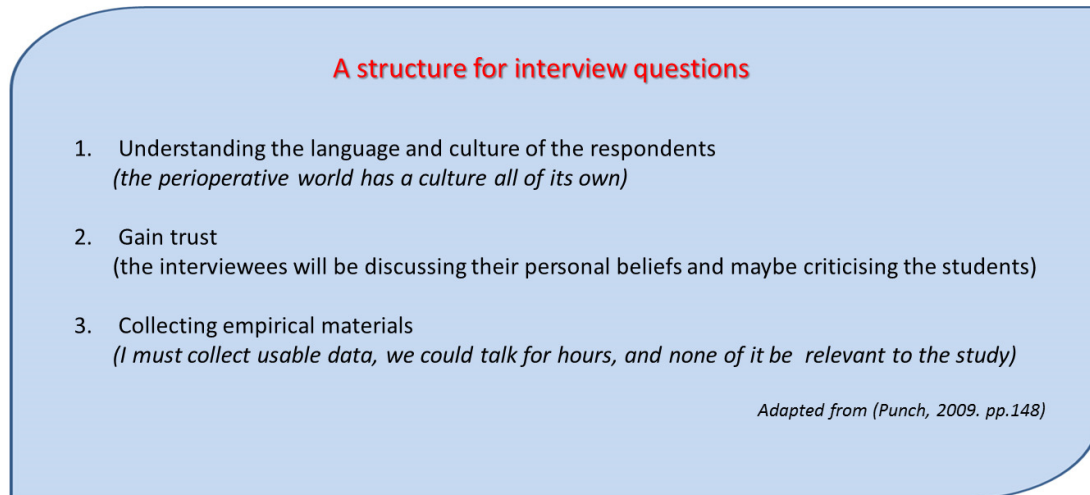


figure 3

Moule (2015) offers flexibility in the transcription of the interview as researchers chose between handwritten and electronically recorded notes. In contrast, Punch (2009) associates highly structured interviews with the use of precoded answer sheets, but suggests that open ended interviews be tape recorded, video recorded and /or noted by hand. Dahlberg, Dahlberg and Nyström (2008) are adamant that interviews be transcribed verbatim, emphasising that all nonverbal data should be included, such as periods of silence, coughing, crying and hesitations, concluding that research data is always less than the research situation. It was decided to record these semi-structured interviews and moved to consider how to engage with this data.

Isolating Thematic Statements

Van Manen (1997) developed the concept of isolating thematic aspects of a phenomenon within text through a three stage process captured in figure 4.

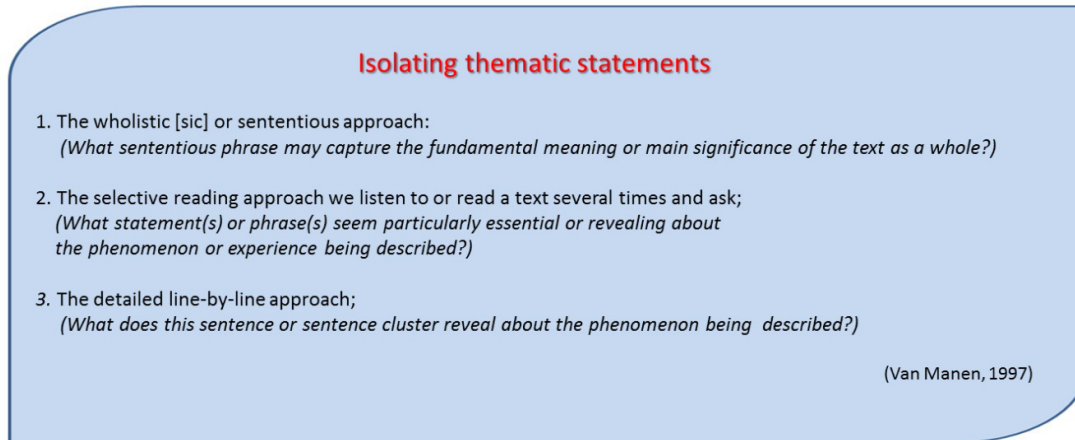


figure 4

Phenomenological Reflection Structure for this Study

The reflections contained herein were formed from statements made by the participants as the convention of phenomenology requires the content of the interviews is the participants' reflection of the phenomenon. Having reviewed the literature informing the area of research, it was concluded that no one method of interpreting the reflections affords a structure for this study. Therefore a hybrid approach for this reflective interpretation was implemented (figure 5).

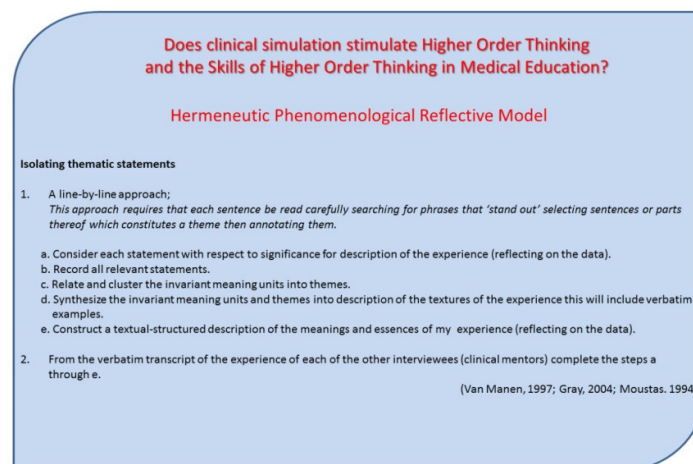
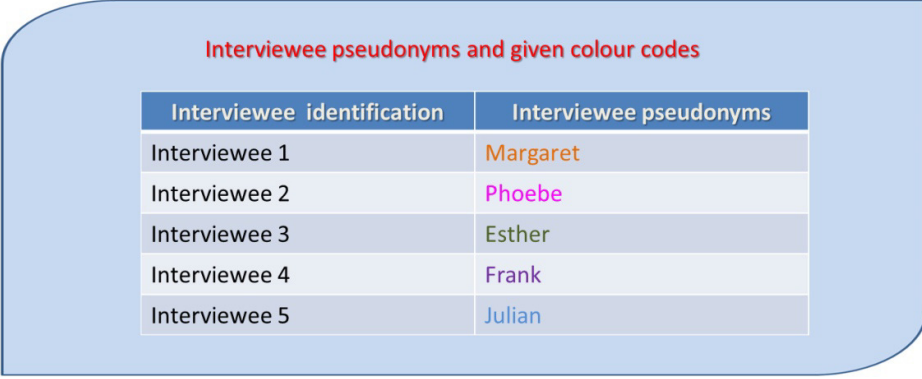


figure 5

Hermeneutic Phenomenological Reflection

For clarity and anonymity, pseudonyms for the lead clinical mentors were used when theming participants' reflections (figure 6). The group of students that had no exposure to simulation was Cohort 1 and the group of students with simulation engagement was Cohort 2. Participants' verbatim quotes were used to reveal their true essence and square brackets were used to denote additions for clarity. A code has been devised to identify quotes from the transcripts, for example, 'Frank (P.3:L35)' denotes the statement comes from Frank's transcript page 3, line 35.



Interviewee identification	Interviewee pseudonyms
Interviewee 1	Margaret
Interviewee 2	Phoebe
Interviewee 3	Esther
Interviewee 4	Frank
Interviewee 5	Julian

figure 6

Theme 1: proactive and prepared

Interviewees identified that students in Cohort 1 (those without simulation experience) were reluctant to participate and required more encouragement, whilst students in Cohort 2 (those who had engaged with simulation) demonstrated self-directed and proactive attitudes and behaviours. A study, revealed through the literature review, concurs with this finding as Alinier *et al.* (2006) compared and contrasted two student groups and found that the students exposed to simulation outperformed in their assessments and clinical practice compared to those students with no simulation experience. The inference from the interviewees' comments below is that students who have engaged in simulation know what is expected of them, are more motivated, are less likely to procrastinate, and have the confidence to take ownership of their educational needs and aspirations.

"... I think they're more proactive. You're working with them and then they're, they're offering to go and do stuff and they'll know, they go in, they get it prepared for the case and then obviously we come in and check

everything, but they just seem, on the whole – they're more prepared."

Phoebe (P6:L2)

"They are just a lot more organised overall, and ... we meet up, and he just tells me what he needs to do and every now and again I just check that he's done what he's supposed to, and he has". Phoebe (P6:L2)

"For the second years [Cohort 1] my experiences were ... almost like more spoon-fed in terms of attention to detail, in terms of reminding them things had to be done a certain way." Frank (P.1:L36)

"Yes, they're, like, more proactive, do you what I mean? They're more, they were more analytical, like, questioned things, "Oh we've done that in school..." Julian (P.1:L5)

"But because they [Cohort 2] knew that it was part of an OSCE [objective structured clinical examination], they were more readily, wanting to learn a bit more, so I think having the OSCE has made them focus a bit more on things that they need to do". Esther (P.2:L34)

"... the one difference, I think, is that they're a lot more self-directed, yeah and a bit more initiative and when I ask them, "Okay, you need to do this, what do you think you should do?" They've put a little bit of thought into it". Frank (P.5:L7)

As a clinical educator, it is exhilarating that four out of five of the lead clinical mentors identified new and positive behaviours in students from Cohort 2. The interviewees described proactivity and self-directedness which likely contributes to students' confidence highlighted in theme 2.

Theme 2: confidence

Interviewees shared that student confidence levels differed between the two cohorts: students in Cohort 1 were less willing to take the lead whilst students in Cohort 2 demonstrated far more confidence in a variety of ways. Again, the literature review reflected findings from Weller's (2004) study where it was suggested that students liked simulation and being in a safe environment, which fostered confidence in the simulator as the students

knew that they would do not harm to real patients, and then carried that confidence to the true clinical environment. This can be seen in the interviewee's comments:

"...a lot more confident because, and I think because they've gone through ... the 'dummy run' with the patient questions, they don't have that initial, they're not as nervous anymore." Phoebe (P6:L12)

"Yeah, that's exactly what I had the other day. I had my student constantly stopping everyone; they were actually more focused on it than I think we are. Obviously, we do it, but he was very, I suppose, very regimented with how things needed to be done, and of course, he's had this training from the beginning whereas the rest of it, remembering it and just adding it into our practise, whereas for him that's the norm." Phoebe (P8:L20).

Phoebe is referring to the World Health Organization (WHO) Surgical Safety Checklist (2014) in which her phrase 'stopping everyone' refers to calling a 'timeout' whereby all members of the team, no matter their profession, pause whilst the person who called the 'timeout' proceeds with the Surgical Safety Check list. A first year student that possesses the courage to stop consultant grade medical staff in the hierarchical NHS, demonstrates, as Phoebe intimates, a high level of confidence. Other participants also identify this confidence:

"I think they're a bit more self-assured. Fitting in, I think, is a little bit easier, because maybe they understand. And I think being able to understand things a little bit more and having, maybe, a perspective, I think their confidence and their comfort levels increase as well, and they seem to be a lot more self-directed." Frank (P.5:L15)

"... well I was quite impressed...like, taking a lead, for example, with the 'WHO checklist' and things." Julian (P.2:L8)

"The students seem more confident; the second batch [Cohort 2] are more confident than the previous ones [Cohort 1]." Margaret (P.2:L11)

"Confidence, yeah...so I think that did, because they could actually see that there was a goal at the end of it, and they could see that there was an improvement, so I think yeah, the OSCEs are a good idea". Esther (P.4:L3)

"Instead of, like previously, we gave a, we did more spoon feeding, we gave answers and things, this time I think it's almost like you're growing a different breed of student ODP where they're probably a lot more, maybe, reflective... maybe more confident." Frank (P.5:L14)

"It's not just because I have to see them [Cohort 2] every week, but because in between those weeks if they've got a problem they will actually, are quite confident, and approach me saying, 'I've got a problem with this. I need to be doing this or Philip has asked me to do this. How will I go about doing it?'" Frank (P.5:L.13)

Reflecting upon the interviewee's comments, it is significant that Cohort 2 students were deemed confident as this is a positive attribute in clinical practice. However, this statement comes with the caveat that over-confidence can be negative and detrimental to patients' safety. Confidence must be proportionate to the knowledge and skills of the developing practitioner. Thus highlighting the importance of Theme 3, in which the retention of this new knowledge is vital.

Theme 3: retaining knowledge

Interviewees identified that students in Cohort 2 demonstrated an ability to retain knowledge. Whilst only being addressed superficially and without consensus between Esther and Julian, this theme is significant to the higher order thinking component of the research question. The literature review identified Goodwin and Wimer (2010, p. 23) who were concerned with "...poor long-term recall, lack of clinical reasoning skills, and lack of self-directed learning skills" identified amongst medical and health professionals. These researchers introduced problem based learning (PBL) into the higher order thinking debate and through the evaluation of PBL in the classroom and clinical practice, found a significant increase in long-term recall and clinical reasoning. Whilst not breaking the deadlock between Esther and Julian, the comments below indicate that further research is necessary:

"...one [student from Cohort 2] is more than capable of retaining and wanting to learn. I don't know whether that is a maturity thing, because one of them obviously is a bit older than the other, so that comes across..."
Esther (P.1:L14)

"...I just think this group, they are different, but then, as the other ones have gone in and they get more and more and more experience in coming towards the end, it's amazing what they have retained." Julian (P.2:L35)

It is disappointing, yet not unexpected, that only two of the five interviewees addressed the issue of knowledge retention. Because the development of Higher Order Thinking Skills is related to knowledge retention, this is a theme worthy of exploration. The contrast in the interviewees' responses may be indicative of the theory/practice divide as some interviewees appear to be interested in knowledge and practice whilst others seem to focus only on practice skills. However, this seems to be related to a fascinating transition that appears to be occurring within the student-mentor dynamic explored in the Theme 4.

Theme 4: mentor and student interaction

Through the benefits of a semi-structured interview, interviewees were able to introduce topics that they felt significant. Interviewees shared that their relationship with the student who has experienced simulation had changed in that Cohort 1 students required more encouragement to engage in clinical activities. Yet Cohort 2 students readily engaged in the clinical activities inspiring the mentors to invest their energies as learning 'coaches' that were eager to see their 'athletes' succeed. The inference is that students in Cohort 2 are demonstrating higher order thinking skills and higher performance levels thus demanding a change in mentorship styles. There was nothing within the reviewed literature pertaining to the relationship between the clinical mentor and their student, however, as four out of five interviewees raised the subject it is therefore significant and should be further investigated.

Interviewees shared:

"The other interesting thing is, the mentors have, much more, taken the ODP students to them, so they feel responsible and accountable much more for those students, so when the students didn't quite make it through their OSCEs, the mentors were very upset that their student hadn't made it and wanted to know why, which in previous years wouldn't have happened..." Margaret (P.5:L19)

"I just think, they just seem to be a bit more, they want to get more involved because they've had that bit of experience in the classroom, they can actually say, 'I've done that, I've had a go, can I have a go now?' Where you used to watch them a few times and say, 'Well, you watch for a little while and see'. Where it's now, 'Yeah go on, yeah go on, just get in there.'"
Julian (P.4:L13)

Again, as Margaret articulates, the Objective Structured Clinical Examination component of simulation has been identified as a significant influence and we see evidence of Frank's 'partnership' with the students' engagement with simulation and acquisition of higher order thinking and skills of higher order thinking being the significant driver for change. But Frank offers a warning regarding students with simulator experience:

"I think because they know the theory, because they've applied it in their practice and during their simulation, I think they know what should be done as opposed to what they've been shown without the theory and stuff behind it, so I think the expectations are probably a bit higher of mentors and that could possibly be a bit challenging." Frank (P.2:L12)

Interestingly, Frank's perception reveals that as the students experience simulation and acquire higher order thinking, a different theory/practice divide develops between the students' practice and the mentors' practice. A significant movement in the theory/practice divide has been observed: a student confided that an 'old school tech' had told her "don't listen to them at Uni, this is a practical job, you don't need book learning!" (unattributed, 2015). This quote is not unique to the ODP profession and its sentiments are articulated in the literature of many of the health professions. However, four out of the five interviewees described mentors taking an increased interest in the students' academic development, leading to a change in their mentoring style and attitudes. It would appear that this paradigm shift, with mentors valuing theory and practice more equally, is worthy of further investigation.

Discussion

It was logical, from a research educationalist perspective, that the two research interests, clinical simulation and higher order thinking, be combined. The literature review revealed studies related to simulation and to higher order thinking skills, but were focused upon student satisfaction or equipment. Instead, the focus of this study was the influence of simulation on the student's acquisition of higher order thinking and the skills of higher order thinking. Uniquely, this study drew upon the perceptions of the lead clinical mentors (those that supervise the students' engagement within their clinical placements for two years). This supervision and introduction of simulation revealed the lead clinical mentors' favourable position comparing and evaluating the two student cohorts. These factors led to the formulation of the research question "Does clinical simulation stimulate higher order thinking skills in medical education - The clinical mentor's perception?"

Findings

The research question was "Does clinical simulation stimulate higher order thinking skills in medical education - the clinical mentor's perception?" and its subquestions included: What learning and teaching factors enhance HOT's in simulation? How does simulation improve confidence, proactiveness, preparedness, retention of knowledge, problem solving and the development of mentor and the student interactions? The criterion of 'perception' was met through the collecting and interpretation of the clinical mentors' thoughts and comments.

Spooner, Hurst, and Khara (2012, p. 58) suggested that "cognitive and didactic benefits, such as situational awareness, coupled with behavioural and communication skills can be developed and honed through simulation while avoiding risk of harm to actual patients from procedures performed by inexperienced trainees". This stance is supported by the interviewees' observations of the students who had engaged with simulation: *"They know what to touch; what they're not allowed to touch. They know the equipment"*. Phoebe (P.1:L.9)

When addressing the question: what learning and teaching factors enhance HOT's in simulation? Interviewees, in line with assertions from Spooner, Hurst, and Khara (2012) identified technical understanding, people skills, social maturity, and situational awareness as benefits of simulation. When defining higher order thinking, Chauvin (2015) adapts Bloom's taxonomy whereby attributes, such as awareness, understanding the act, and adopting behaviours associated with value(s), are identified as higher order thinking skills and mirrors the lead clinical mentors' narratives.

When considering how may simulation improve confidence, proactiveness, preparedness, retention of knowledge, problem solving and the development of mentor and the student interactions, Swing (2007) offered six domains of clinical medical competence: patient care, medical knowledge, practice-based learning, improvement of interpersonal and communication skills, professionalism, and systems-based practice. These domains were somewhat identified by the interviewees' opinion of students in Cohort 2: *"Well I was quite impressed for, like, an early stage, like, taking a lead, for example, with the 'WHO check list' and things."* (Julian P.2:L.9). This is significant as this demonstrates students proactively taking a lead in patient care and safety. Interviewees addressed the impact of simulation on the students' knowledge, developing interpersonal and communication skills, and their subsequent performance in the clinical setting: *"Yes, they're, like, more proactive; do you know what I mean? They're more, they were more analytical, like, questioned things, "Oh we've done that in school".* Julian (P.1:L3). Khan, Pattison, and Sherwood (2011) extolled the virtues of simulation in developing the professional characteristics of empathy, compassion and integrity. Likewise, the interviewees identified their perceptions of the students' developing professionalism, such as leading patient safety checks, forming partnerships with clinical mentors, and taking ownership of their education are implicitly addressed: *"...going through the list, actually being part of the team brief, because that is obviously being introduced this time, and making, like, suggestions"* (Julian P.3:L16). In Swing's (2007) final domain, the student demonstrates systems-based practice; this is also demonstrated by the interviewee when he suggests: *"...it's about sequencing isn't it? Yeah, and understanding why you do things a certain way"* (Frank P.4:L.24).

One could ask how mentors perceive higher order thinking skills as the lead clinical mentors are not educationalists and therefore may not have a perception of higher order thinking skills. This does not negate the clinical mentors' contributions to this study, for they can give their perceptions of the student cohorts' activities and it is for the researcher to interpret these perceptions and identify higher order thinking skill characteristics. Likewise, one could ask how are higher order thinking skills used in simulation, creating a 'chicken and the egg' dichotomy leading to confusion, as the research question asks "Does clinical simulation stimulate higher order thinking skills...". However, Beckwith (2018) negates this question by offering that higher order thinking skills are in fact Higher Order Thinking & Skills of Higher Order Thinking (HOTSHOT). Beckwith (2018) offers a Signature Pedagogy framework which for the purposes of perioperative practice can be populated by themes 1-4 in this study (see figure 7).

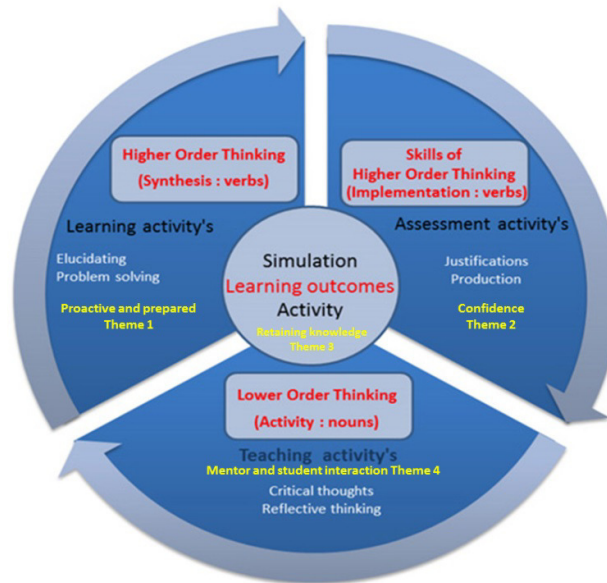


figure 7

Conclusion

Limitations of the study

Some may consider this a small study, consisting of five interviews of fifteen minutes each, that focused upon two cohorts numbering forty-six students. Yet Dahlberg, Dahlberg and Nyström (2008) suggested five interviewees as the optimum starting number and manageable for the hermeneutic researcher seeking quality responses.

Research contribution

A review of the literature revealed a deficit in the body of knowledge relating to operating department practice (ODP) education and simulation. The aim of this study was to address this deficit. This study was an exploration of the perceptions of five lead clinical mentors' relating to two student ODP cohorts (forty-six students in total). The data discussed demonstrates the lead clinical mentors' perceptions of a correlation between simulation and acquisition of higher order thinking and the skills of higher order thinking in ODP students. Some may consider this a bold statement, or even irresponsible, with such a small study, yet the research is more than the sum of its parts. Whilst the study does not prove that clinical simulation stimulates higher order thinking skills (or Higher Order Thinking and the Skills of

Higher Order Thinking), it does support it and is therefore significant. Furthermore, a theme emerged indicating that simulation impacts how students are mentored and the student-mentor relationship. Whilst these findings do not fill the gap in the body of knowledge (due to the limitations described) they do go some way in plugging it. The hope is that this study will stimulate further research on this topic.

Recommendations

Further knowledge could be gained by enhancing this study develop it through repetition at a national level, involving all 27 institutions delivering this course of study and clinical mentor attached to these institutions. When looking at the future and the benefits of developing a signature pedagogy for operating department we can draw upon the statement “the types of teaching that organize the fundamental ways in which future practitioners are educated for their new professions” (Shulman, 2005 p52).

Through engaging in this study in which I explore ‘Does clinical simulation stimulate higher order thinking skills in medical education - The clinical mentor's perception?’ Hopefully further research will help others value simulation and advance the use of simulation use the Signature Pedagogy with ODP students in developing Higher Order Thinking and the Skills of Higher Order Thinking rather than simply repeating skills.

Author's biography

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